

Habitability

Lead Increment Scientists Briefing

Sherry Thaxton, Ph.D.

January 2015



Habitability Assessment of International Space Station [Habitability]

<p>Habitability</p> <p>Sherry Thaxton, Ph.D.</p>	<p>Lead Increment Scientists Briefing</p>
	<p>January 2015</p>
<p>Science Background</p> <p>The purpose of this study is to assess habitability during the International Space Station 1-year mission, and subsequent 6-month missions, in order to better prepare for future long-duration spaceflights to destinations such as Near Earth Asteroid (NEA) and Mars, which will require crewmembers to live and work in a confined spacecraft environment for over a year.</p> <p>Data collected using Space Habitability Observation Reporting Tool (iSHORT), crew-collected videos, questionnaires, and PI conferences will help characterize the current state of habitability for the ISS. These naturalistic techniques provide crewmembers with the opportunity to self-report habitability and human factors observations in near real-time, which is not systematically done during ISS missions at present.</p>	

Objectives

- To characterize the current state of ISS habitability.
- To document/characterize details about how crewmembers currently utilize the space on ISS.
- The specific focus areas include: Private personal areas, Group activities, Suit donning and doffing, Crew health and medical procedures, and Stowage.



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Experiment Design Overview

Preflight	Inflight	Postflight
N/A	Habitability Overview Video (1 session per subject)	N/A
	Habitability and Human Factors Observations (Up to 50 sessions per subject)	
	Walk-through video (Up to 12 sessions per subject)	
	Narrated Task video (Up to 12 sessions per subject)	
	Habitability and Human Factors Questionnaires (Up to 3 sessions per subject)	
	Post-Questionnaire PI Conference (Up to 3 sessions per subject)	

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<p style="text-align: center;">Habitability Overview Video</p> <p>Session Synopsis</p> <ul style="list-style-type: none"> • Crewmembers will view a short video in-flight explaining: <ul style="list-style-type: none"> • The iSHORT application • Habitability points of interest on the ISS <p>In-flight Schedule</p> <ul style="list-style-type: none"> • Up to 1 session/subject • 15 minutes of crew time • This session will be scheduled within 24 hours prior to the first Observation, Narrated Task, or Walk-Through Session 	

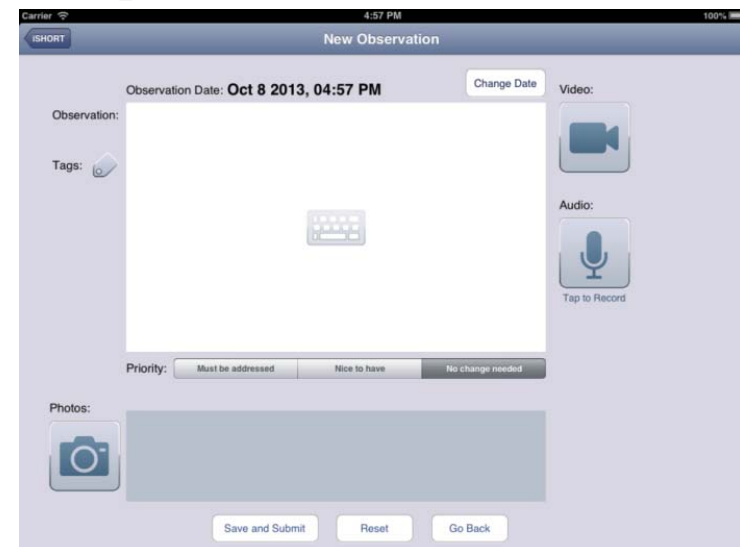
Habitability and Human Factors Observations

Session Synopsis

- Crewmembers will be scheduled to use the iSHORT application on the flight iPad to document habitability observations about topics such as
 - Environment (noise, lighting, odor, etc.)
 - Equipment (hardware, clothing, software, etc.)
 - Operations and activities (timeline, sleep, stowage, etc.)
 - Group interactions (with ground, leadership, culture difference, etc.)

In-flight Schedule

- Up to 50 sessions/subject
 - 25 nominal sessions
 - 25 reserve sessions
- 15 minutes of crew time per session
- Additional Habitability and Human Factors Observations may be recorded per crew choice.



Walk-through video

Session Synopsis

- Crewmembers will be scheduled to use iPad with iSHORT to provide a guided tour of ISS locations such as:
 - Stowage areas
 - Hatches
 - Sleeping quarters
 - And others per crew discretion



In-flight Schedule

- Up to 12 sessions/subject
 - 6 videos will be of pre-determined location
 - 6 videos will be per crew discretion or from candidate list
- 25 minutes of crew time per session

Narrated Task video

Session Synopsis

- Crewmembers will be scheduled to use iPad with iSHORT during a task and will talk to the camera about what they are thinking during the task with respect to the hardware being used and the environment in which the task is being performed.
 - Medical Ops drills
 - Evacuation drills
 - And others per crew discretion

In-flight Schedule

- Up to 12 sessions per subject
 - 6 videos will be pre-determined tasks
 - 6 videos will be per crew discretion
- 25 minutes of crew time per session



Habitability and Human Factors Questionnaires

Session Synopsis

- Crewmembers will complete questionnaires related to
 - behavioral health,
 - habitability, and
 - human factors in the iSHORT application

In-flight Schedule

- Up to 3 sessions per subject
 - FD45 (+/-30), FD175 (+/-30), and R-45 (+/-30)
- 20 minutes per session

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<p>Post-Questionnaire PI Conference</p> <p>Session Synopsis</p> <ul style="list-style-type: none"> • Crew conference with PI for follow-up questions from the Habitability and Human Factors Questionnaire <p>In-flight Schedule</p> <ul style="list-style-type: none"> • Up to 3 sessions per subject <ul style="list-style-type: none"> • Will follow Habitability and Human Factors Questionnaires • FD45 (+/-30), FD175 (+/-30), and R-45 (+/-30) • 15 minutes per session • If more than one subject on-orbit, these sessions will not be scheduled concurrently. 	

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<div>Risks & Discomforts</div>								
<table><tr><th>Test</th><th>Risks/Discomforts</th><th>Mitigation</th></tr><tr><td>N/A</td><td></td><td></td></tr></table>			Test	Risks/Discomforts	Mitigation	N/A		
Test	Risks/Discomforts	Mitigation						
N/A								

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Test Constraints

Test	Constraints
N/A	

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Summary

Preflight	Inflight	Postflight
N/A	Habitability Overview Video (1 sessions, 15 minutes)	N/A
	Habitability and Human Factors Observations (Up to 50 sessions, 15 minutes each)	
	Walk-through Video (Up to 12 sessions, 25 minutes each)	
	Walk-through Video (Up to 12 sessions, 25 minutes each)	
	Habitability and Human Factors Questionnaires (Up to 3 sessions, 20 minutes each)	
	Post-Questionnaire PI Conference (Up to 3 sessions, 15 minutes each)	
Total Time: 0 minutes	Total Time: 1095 minutes + 375 minutes reserve time	Total Time: 0 minutes

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<p style="text-align: center;">Importance of Study</p> <ul style="list-style-type: none"> • Habitability and human factors issues become more critical during long-duration missions • Currently, collection of habitability and human factors data is limited to operational data <ul style="list-style-type: none"> • Unsystematic (e.g., Crew Notes and call-downs) • Weeks or months after the mission (post-mission debriefs) • This study will help designers better prepare for future long-duration spaceflights to destinations such as Near Earth Asteroids (NEA) and Mars, which require crew members to live and work in a confined spacecraft environment for over a year. 	

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<div> <h2>Reason for ISS</h2> </div> <div> <ul style="list-style-type: none"> • This study will provide unique insight into the day in the life of an International Space Station crew member <ul style="list-style-type: none"> • Characterize ways crew members live and work in microgravity • How interactions with environment might require layouts, additional space, or alterations to future space vehicles or habitats • Capture crew member feedback closer to real-time • Operational spaceflight is the only environment that will provide realistic insight into the living and working needs of astronauts </div>	

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<div> <h2>Expected Results</h2> </div> <div> <ul style="list-style-type: none"> • Characterization of the current state of habitability on ISS • Better understanding of how much habitable volume is required for vehicle internal design and layout, and if mission duration impacts the volume needed • Updated requirements and design standards to guide development of future vehicles and habitats for long-duration missions </div>	

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<div> <h1>Earth Benefits</h1> </div> <div> <ul style="list-style-type: none"> • Jobs in many industries require long-duration stays in confined spaces in remote locations <ul style="list-style-type: none"> • Ocean drilling rigs • Polar research stations • Mines • Results from this investigation may benefit workers who must live and work in confined spaces with limited volume and resources </div>	